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Rigorous Approach to Scheduling of Sterile Drug Product Manufacturing

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Abstract

Optimizing the scheduling of liquid drug product manufacturing is paramount for pharmaceutical companies in their increasingly competitive environment and requires the modelling of industry-specific constraints. Such constraints include: (i) changing sequence-dependent setup times; (ii) maintaining a sterile production environment (e.g., through sterile holding times); (iii) periods with limited or no plant activity (e.g., no workforce during weekends); and, (iv) demand timing (i.e., delivery deadline and release date constraints). In this work, an immediate precedence model is formulated to optimize the scheduling of liquid drug product manufacturing, considering the industry-specific constraints. The primary objective is to minimize the production makespan.

Four case studies comprising up to 38 batches from a real multi-product facility illustrate the performance of the rigorous optimization approach. The makespan could be reduced by up to 7.9 % compared to expert schedules.

Keywords:
Mathematical Optimization, Mixed-Integer Linear Programming, Scheduling, Batch Production, Industrial Application, Campaigning

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